INTERREG MED Programme

2014-2020

ESMARTCITY

Enabling Smarter City in the MED Area through Networking

(3MED17_1.1_M2_022)

Priority Axis 1. Promoting Mediterranean innovation capacities to develop smart and sustainable growth

Specific Objective 1.1 To increase transnational activity of innovative clusters and networks of key sectors of the MED area

WP4 – Transferring

Activity 4.2 – Capacity Building Interventions

Deliverable 4.2.1 – "Lessons Learnt on Enhancing Innovation through the Smart City concept" Capacity Building Sessions and Material

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Dissemination Level		
PU	Public	x
PP	Restricted to Programme Partners and MED Programme	
RE	Restricted to a Group defined by the Partnership and MED Programme	
CO	Confidential, only for members of the partnership and MED Programme	

Contents

1 Introduction

1.1 Scope and objectives of the deliverable

This report has been developed within the ESMARTCITY project of the European program Interreg MED, and serves as a deliverable for the activity A4.2 “Capacity Building Interventions”. More specifically, it represents D4.2.1 “’Lessons Learnt on Enhancing Innovation through Smart City concept’ Capacity Building Sessions and material” and its aim is to develop training guidelines about knowledge acquired and learned lessons in developing, testing and assessing the intervention strategies on how to enhance innovation ecosystems through the smart city concept.

The guidelines are expected to be utilized for the capacity building capacity interventions of the project and more specifically the 8 capacity building workshops scheduled, 2 transnational and 6 local workshops.

The capacity building workshops target policy makers and more specifically local and regional public authorities aiming at improving their capacities related to innovation enhancement related to the Smart City concept, bringing the Smart City concept in the core of their activities for innovation and entrepreneurship enhancement in the MED area.

The aim of the workshops is threefold: to transfer the necessary knowledge to policy makers utilizing the knowledge built in the framework of the project especially in WP3 and deliverable 3.4.1 “Green paper for Innovation Policy Change”, to develop necessary skills in policy makers at regional and local level of MED partner countries, and influence their attitude towards innovation enhancement through the Smart City paradigm.

1.2 Structure of the deliverable

This deliverable is structured in 6 chapters:

Chapter 1, "Introduction" provides the generalities of the deliverable identity.

Chapter 2, "Capacity Building Schedule" presents the anticipated schedule of Capacity Building interventions.

Chapter 3, “Session management guideline for training coordinators” presents practical interactive session management guideline.

Chapter 4, "Capacity Building Guidelines" presents the specific guidelines for the capacity building interventions drawn around specific policy recommendations selected from the “Green Paper for Innovation Policy Change” deliverable.

Chapter 5, "Successful Experiences" presents public experiences especially related to public lighting and smart public buildings that could be utilized by policy makers in the MED countries as beacons of the Smart City paradigm.

Chapter 6, “Guideline on implementation of Session 3” presents general guideline on how to organize Session 3 by each partner.

2 Capacity Building Schedule

The project will enroll into 8 capacity building interventions towards policy makers in the partner areas. The interventions will be either transnational (2 interventions in East Sarajevo, Bosnia Herzegovina and Patras, Greece) or local (6 interventions in Pescara, Milan, Granada, Lisbon, Lyon and Aix-en-Provence). Depending on the type of intervention the duration will be adjusted between half day and 2 days, with transnational interventions aiming at providing a wider impact and dealing with extended themes related to the Smart City context than local ones.

A general guideline on the capacity building intervention schedule is as follows:

- Opening Session
  - Registration of participants
  - Presentation of participants
  - Definition of objectives
  - Full introduction of trainers – speakers
  - Outline of scheduled course activities

- Training Session 1: European Smarter Cities
  - Learning objectives comprise the following:
    - Understand and define Smart City paradigm and technologies
    - Have an overview of EU 2021-2027 Cohesion Policy Framework
    - Present the City Digitalization Roadmap

- Training Session 2: Innovative approach in Funding Policies
  - Learning objectives comprise the following:
    - Mandatory Specific Objectives from 2021-2027 Cohesion Policy Framework impacted by Esmartcity project – select at least two among preselected "Green Paper on Innovation Policy Change" Policy Recommendations #3, #6, #9 representing highly influential recommendations proposed by Esmartcity
    - Additional Specific Objectives from 2021-2027 Cohesion Policy Framework impacted by Esmartcity – taking into account the specific local requirements set by the local territory strengths, weaknesses and opportunities

- Training Session 3: New technologies in the service of citizens
    - Learning objectives comprise the following:
        - To collect public experiences related mainly to the two technological themes of Esmartcity project, i.e. Smart Public Building and Smart Street Lighting, that could be further enhanced and enriched with services for the citizens
        - To present case studies coming from the local experience associated mainly to the two technological themes of Esmartcity project, i.e. Smart Public Building and Smart Street Lighting, eventually leading to new services for the citizen that could be easily added to the already offered ones

The three training sessions provide, in short, the policy makers – attendees of the capacity building interventions with:

- Knowledge on the Smart City Paradigm in general and the technological solutions available in the themes covered by Esmartcity project with an eye on Innovation Enhancement in the MED territories;
- Knowledge on the 2021-2027 Cohesion Policy Framework and its specific objectives and funding opportunities presented;
- Training on specific highly influential Policy Recommendations presented by the Esmartcity project and their way of innovative funding so that the MED territories enhance their Innovation through the Smart City paradigm;
- Training on specific technological solutions that may be put in the service of the citizens in the MED territories and enhance the citizen well-being while creating adequate end user demand.

3 Session management guideline for training coordinators

The following suggestions may be helpful to training coordinators:

- Introduce the discussion topic.
- Explain key points.
- Create few table groups and assign a key point per table to discuss (10 min).
- Support table groups in their discussion.
- Assign an animator per table group with the ability to instigate discussion on the topic in coordination with the coordinator. Depending on the capacity of each partner, the animator could be staff / external expert of the partner or a member of the local policy stakeholder network with related ability
- Each group individuate a speaker that reports the group's contribution. (40 min)
- Collect and summarize the groups' contribution. (10 min)
- Interactive Workshop.

The workshop method is used to seek, explore and identify the solutions to a problem, to permit the extensive study of a situation, it's background and it's social implications. It is used for trainer(s) for giving awareness and training of new practices and innovation in city's development. It provides an opportunity to prepare specific professional, vocational or community, service functions. A high degree of individual participation is encouraged. Finally, it allows group determination of goal and method.

4 Capacity Building Guidelines

The capacity building interventions narrow down to specific policy recommendations of the Esmartcity project defined in the "Green Paper for Innovation Policy Change" that are deemed mandatory for inclusion in the capacity building workshops. According to the local needs, the 2 transnational workshops and 6 local workshops may opt to include further policy recommendations to present / analyze.

The policy recommendations selected are the following:

- Policy Recommendation #3: Inclusion of Green Smart Public Buildings and Smart Public Lighting in national funding schemes, ROPs, RIS3 and local Action Plans;
- Policy Recommendation #6: Compulsory adoption and use of EU GPP criteria from national and regional public authorities;
- Policy Recommendation #9: Funding the implementation of PPI and PCP through national funding schemes, ROPs and RIS3.

For each of the selected policy recommendations a description is provided, the current legal / regulatory framework is presented, successful experiences on the implementation of the legal / regulatory framework in the MED area are detailed, and the aims of local stakeholder / policy maker participation are presented including indicators on the feedback to gather on local conditions and experiences.

For the purpose of reader convenience, the following table comprises 2021-2027 ERDF and CF related Policy Objectives (POs) and Specific Objectives (SOs).

Policy Objective		Specific Objective		Fund
PO 1	*Smarter Europe -innovative and smart industrial transformation*	**a1**	Strengthen research and innovation capacities and the introduction of advanced technologies	ERDF
		a2	allow citizens, businesses and public administrations to reap the benefits of digitization	ERDF
		a3	strengthen the growth and competitiveness of SMEs	ERDF
		a4	develop skills for smart specialization, industrial transition and entrepreneurship	ERDF
PO 2	*A greener, low carbon Europe -*	**b1**	promoting energy efficiency measures	CF/ERDF

	clean and fair energy transition, green and blue investment, circular economy, climate adaptation and risk prevention	**b2**	promoting renewable energies	CF/ERDF
		b3	developing smart energy systems, grids and storage at local level	CF/ERDF
		b4	promoting climate change adaptation, risk prevention and disaster resilience	CF/ERDF
		b5	promoting sustainable water management	CF/ERDF
		b6	promoting the transition to a circular economy	CF/ERDF
		b7	enhancing biodiversity, green infrastructure in the urban environment, and reducing pollution	CF/ERDF
PO 3	*A more connected Europe - mobility and regional ICT connectivity*	**c1**	enhancing digital connectivity	ERDF
		c2	developing a sustainable, climate resilient, intelligent, secure and intermodal TEN-T	CF/ERDF
		c3	developing sustainable, climate resilient, intelligent and intermodal national, regional and local mobility, including improved access to TEN-T and cross-border mobility	CF/ERDF
		c4	promoting sustainable multimodal urban mobility	CF/ERDF
PO 4	*A more social Europe - implementing the European Pillar of Social Rights*	d**1**	use of technology to improve citizen participation	ESF+
PO 5	*Europe closer to citizens - sustainable and integrated development of urban, rural and coastal areas*	**e1**	promoting integrated social, economic and environmental development, cultural heritage and security in urban areas	ERDF
		e2	promoting social, economic and environmental development integrated at local level, cultural heritage and security, also for rural and coastal areas, inter alia through participatory local development	ERDF

	through local initiatives		initiatives	

The EU Cohesion Policy represents the European Union's main investment policy, aiming at encouraging economic growth in EU member states and their regions. Regional Policy targets all regions and cities in the European Union in order to support job creation, business competitiveness, economic growth, sustainable development, and improve citizens' quality of life. It is reviewed every 7 years. The current Cohesion Policy covers the programming period 2014-2020.

Cohesion Policy is delivered through three main funds.

- European Regional Development Fund (ERDF): aims to strengthen regional economic and social cohesion by investing in growth and enhancing sectors to improve competitiveness and create jobs. The ERDF also finances cross-border cooperation projects.
- European Social Fund (ESF): invests in people, with a focus on improving employment and education opportunities. It also aims to help disadvantaged people at risk of poverty or social exclusion.
- Cohesion Fund: invests in green growth and sustainable development, and improves connectivity in Member States with a GDP below 90% of the EU-27 average.

While the Common Provisions Regulation of 2013 sets out the general rules for ERDF and CF, the specific rules are covered by two separate regulations on each of the funds: the ERDF Regulation (Regulation (EU) No 1301/2013 of the European Parliament and of the Council of 17 December 2013 on the European Regional Development Fund and on specific provisions concerning investment for the growth and jobs goal, and repealing Regulation (EC) No 1080/2006), and the Cohesion Fund Regulation (Council Regulation (EU) No 1300/2013 of 17 December 2013 on the Cohesion Fund and repealing Council Regulation (EC) No 1084/2006).

The European Commission has identified 3 main goals for 2020, namely Smart growth, Sustainable growth and Inclusive growth. Each goal is broken down into Thematic Objectives. There are 11 thematic objectives in the 2014-2020 policy, which are presented below:

1. Strengthening research, technological development and innovation
2. Enhancing access to, and use and quality of, information and communication technologies
3. Enhancing the competitiveness of SMEs
4. Supporting the shift towards a low-carbon economy
5. Promoting climate change adaptation, risk prevention and management
6. Preserving and protecting the environment and promoting resource efficiency
7. Promoting sustainable transport and improving network infrastructures

8. Promoting sustainable and quality employment and supporting labour mobility
9. Promoting social inclusion, combating poverty and any discrimination
10. Investing in education, training and lifelong learning
11. Improving the efficiency of public administration

Out of these, the first four have been identified as major objectives for the 2014-2020 period. The selected policy recommendations can be associated to all four major thematic objectives of the Cohesion Policy.

4.1 Policy Recommendation #3: Inclusion of Green Smart Public Buildings and Smart Public Lighting in national funding schemes, ROPs, RIS3 and local Action Plans

4.1.1 Description

Taking advantage of the technological development and the digital transformation achievements, EU member states and their regions should enhance the investments in Green Smart Public Buildings and Smart Public Lighting. Both public buildings and public street lighting are two sectors which consume the biggest share of the energy consumed by public sector. Thus, the transition to greener and smarter solutions is a one-way decision. The existing industry already moves forward with green smart applications, products and services deployed in public buildings and street lighting infrastructure valorizing existing Open Data. Thus, having multiplier effect for sustainability and addressing more effectively energy consumption problems. Public authorities at all policy levels should support such efforts by carefully including Green Smart Public Buildings (GSPBs) and Smart Public Lighting (SPL) in national funding schemes, ROPs, RIS3 and local Action Plans.

4.1.2 2014-2020 Framework

Strategies for the upgrade of Energy Efficiency of buildings have been an object of purse by the European Union for a long period of time, a pursue which steadily grows in scope. The Directive 202/91/EC of 16 December 2002 on the Energy Performance of Buildings (EPBD) followed earlier relative EU legislation. In March 2007, the European Commission agreed on Europe's 2020 Strategy for green, smart and sustainable growth. The Commission set precise legally binding targets like the reduction of greenhouse gas emissions, energy efficiency, and adoption of renewable energy source. During the same year the Commission published the Strategic Energy Technology (SET) plan which aims at coordinating all the stakeholders (EU, states, individual) to uptake joint funding efforts on research and development to boost the EU's transformation into a

low-carbon energy system. In 2008 the European Parliament and Council accepted the updated version of the EPBD. In 2014 the European Commission proposed more ambitious energy efficiency targets by the 2030 like a 40% reduction in greenhouse gas emissions from the 1990 values, a 27% infiltration of renewable energy sources and a 27% reduce in energy consumption. In November of 2016 under the umbrella term of "Clean Energy for All Europeans" the European Commission issued a number of legislative acts. Among others was the review of EPBD and the proposal of embracing ICT and smart technologies for enhancing the energy efficiency of buildings. This was a pivotal point since for the first time the European Commission encouraged the adoption of technologies for smart buildings.

During the 2014-2020 period both at national and regional level most of the countries of the MED area have used various mechanisms for funding EE projects on Public Building and Public Lighting. The ERDF along with the Cohesion Fund are the two main pillars of funding these initiatives either by providing a part of the total amount of money needed (co-funding) or by providing low-interest loans. A short description of the current situation concerning local, regional and national funds in EE projects that include Public buildings and Public Lighting in the area of the Mediterranean follows[1]:

Albania

In national level an EE law demands the setup of an EE Fund as a separate local entity in the form of a non-profit organization. This Fund will provide financial support to relevant projects and its seat will be in the capital, Tirana. The list of beneficiaries includes all the energy producers, consumers, and end-users. The EE fund will be financed by donors via contracts between the Government and donor entities that want to finance EE projects. These entities include the state budget, local and foreign institutions, and individuals. The EE Fund will fund project whose targets are compatible with the National Energy Efficiency Action Plan (NEEPAP) along with investments that improve the EE of:[1]

- End-users,
- Producers, transmitters, and suppliers of electric power,
- Public lighting,
- Water supply and sewages systems etc.

Albanian banks have provided financing for EE building envelope upgrades with the support of International Financial Institutions (IFIF) and international donors. However, the knowledge of ESCO projects is very limited and a great effort must be put in area in the next period.

Croatia

[1]ENERJ Project, "D 3.2.2 Funding Tools." 2017

The Ministry of Regional Development and EU funds coordinates the Operational Programme "Competitiveness and Cohesion" 2014-2020 which have been developed in cooperation of several public and regional bodies. Its priority axis 4 promotes EE in public buildings and more specifically point 4c with the title “Supporting the transition to a low carbon economy in all sectors, and sub-axis 4c - Support for energy efficiency, smart energy management and renewable energy sources in public infrastructure, including public buildings and in the housing sector.” Moreover, two other national funds, “The Croatian” and the “Third national action Plan”, aim at the refurbishment of Public Buildings with better EE. The Environmental Protection and Energy Efficiency Fund (EPEEF) is the focal point for gathering extra budgetary resources in projects and programmes relevant to EE. In Croatia the main road for financing EE related projects by local or regional authorities is from own budget, from national funds, from EU funds, bank loans, ESCOs, PPP etc.

The Croatian Bank for Reconstruction and Development (HBOR) provides credit for projects related with environmental protection, energy efficiency, and renewable energy source with very low interest rate. Moreover, various alternative banks have provided loans the so-called Green Line. Concerning PPPs, the Laws NN 78/12 and NN 152/14 define the context and the responsibilities of each part of the deal. Finally, in the country there are several ESCO companies whose role is the design, the development, the implementation and the financing of projects aiming at EE and reducing operational and maintenance costs.

Cyprus

The Energy Service of the Ministry of Energy, Commerce, Industry and Tourism (MECIT) has created a funding scheme for the upgrade of EE in Public Buildings and households with a budget of 8,000,000 euros for co-financing the projects. The target of the upgrade is the EPC category B or above, 40% savings or to become nZEB. The fund co-finances a number of actions that must be done in order to satisfy at least two of the three minimum u-values defined by the MECIT after the end of the upgrade. The percentage of the co-funding reaches the 75% and is done through the «RES and EE» fund. Moreover, the European project “ENERGEIN” and national project “SYNERGEIN” have the object of the energy upgrade of buildings belonging to Municipalities or Communities. Concerning the local level, the majority of EE project in Cyprus is financed through local funds of the authorities. Because of the economic constraints EE is not the priority by the local authorities. There some cased of joint funding or procurement via the cooperation mainly for projects that deal with public lighting.

Four banks of Cyprus finance EE projects providing loans. These banks are the Bank of Cyprus, the Hellenic Bank, the Cooperative Central Bank and AstroBank. In addition, several ESCO companies exist for carrying out EE projects.

Greece

"Exoikonomo" and Exoikonomo II" are National Energy Efficiency Programmes for Buildings, both households and public. Other funding schemes in national level are the "Green" Fund, which is a special fund that redistributes the fines collecting for violation of environmental laws. The money is distributed to promote eco-friendly measures. At regional levels, through the Regional Operations Programmes are implemented strategies for upgrading the EE of infrastructures. An example of a funding scheme in regional level is the ROP of DytikiEllada 2014-2020 and more specifically axis 2 entitled as "Environmental protection - transition to an environmentally friendly economy" with the objective to increase the energy efficiency in the business sector as well as for public and private buildings.

The scheme of PPPs only currently was implemented in Greece via the cooperation of ESCOs with local authorities, mainly in the form of replacing public lighting. The economic crisis has limited the infiltration of such schemes since the lack of liquidity has reduced the options significantly.

Italy

In Italy there are primarily two funding mechanisms in national level. The first one is called "FondoKyoteo per le scuole" that aims at promoting the upgrade of EE status of Public Buildings that serve an educational purpose, though granting of subsidized loans. The other mechanism is the "New ContoTermico" which promotes the following actions like thermal insulation of walls and roofs, building automation technologies, indoor lighting etc. Concerning the regional level, the only available fund derives from the European structural funds 2014-2020 and more specifically form Axis 4 "Support of the transition towards a low carbon economy in all sectors", the Investment Priority 4c: "support of energy performance, smart energy management and use of renewable energy resources in public infrastructures, including public buildings" with a total available resource amount of 176,000,000 euros.

Spain

On a national level there is a grant for the EE refurbishment of public and private buildings with a co-financing factor of the investment of 75%. Moreover, a 200,000,000 euros grant is available for local and regional authorities for taking special measures for EE refurbishments of buildings. The amount of the fund is up to 30% of the total cost and the rest is provided through a no interest loan. In addition, a fund of 506,600,000 euros on Law Carbon Economy for municipalities under 70,000 inhabitants (before, now for all municipalities) is approved and is split for to 70% for EE and 30% for RES, covering up to 50% to 80% of the total costs depending on the region. As well, in each Spanish region a specific regional fund of similar characteristics to the national one, has been increasing in the last years, mainly on Public lighting facilities in municipalities, being this one another type of funding scheme.

France

At national level, Energy Savings Certificates (ESC) scheme is one of the main instruments of the energy demand management policy. The ESC scheme, created in 2006, is based on an energy savings obligation imposed by the public authorities on energy suppliers (fuel, electricity, gas, etc.). They must therefore actively promote energy efficiency among energy consumers: households, local authorities and professionals. Quite analogous to the closely related concept of emissions trading, the system guides the project owner towards technologies recognized as efficient by the State, including energy efficiency projects on public lighting and public buildings. One kWh saved leads to the right to one ESC. Public authorities can also sell their certificates on the market. If energy producers do not meet the mandated target for energy consumption, they are required to pay a penalty.

More specifically related to the issue of EE in public buildings, local authorities can make renovation investments by using the Energy Performance Contract (EPC). The EPC is a tool to guarantee contractually and durably the improvement of the energy performance of one or several buildings, i.e., to reduce energy consumption compared to a reference situation.

As part of the “Grand Plan d'Investissement” (Major Investment Plan) special loan to accelerate the energy retrofitting of public buildings has also been in place since 2018, called the "GPI-AmbRE Loan".

Finally, an innovative mechanism fund for EE in public lighting and building can now be used, called “intracting”: this approach is based on the implementation of a specific budget line showing equity capital, repayable advances and savings generated by energy performance actions. This innovative financial scheme consists of carrying out energy performance work that generates energy savings with a payback time of less than 10 years. These savings are allocated to the repayment of advances granted by the Bank of the Territories (50%), or even to the financing of new projects.

4.1.3 Successful local Experiences

The 2020TOGETHER - TOrino is GEttingTHERe[2] – project is a great example demonstrating a set of actions that can be implemented to enhance energy efficiently in public buildings. It involves regional, provincial, and local authorities, financial institutions, local industries and investors. In the context of the project more than 60 public buildings and several public light facilities are refurbished for energy efficiency. The total cost of the investment is 9,420,214 euros and has a leverage factor of 19. The collaboration is safeguarded by the city of Torino, which has a crucial

[2] https://ec.europa.eu/energy/intelligent/projects/en/projects/2020together

role in both coordinating the project but also as a contracting authority. The programme was based on Public Private Partnership and Third Part Investment (TPI). Firstly, an ESCO company raises the capital needed (as equity or/and financed by a third party) and afterwards it makes individual performance contracts with the different Municipal authorities. Inside the contract the following terms are included:

- The ESCO invests in each of the chosen buildings;
- Guarantees are provided that all the buildings will benefit from energy retrofitting measures;
- An expert appointed by the city of Torino is hired to participate in the works of Performance Monitoring and Verification commission.

TOTAL INVESTMENTS INCL. VAT	12.5 MILLION EUROS
PROJECT BUDGET	490,000 EUROS
LEVERAGE	25
CO_2-eq EMISSIONS AVOIDED	4360 TONS
PRIMARY ENERGY SAVED	22050 MWH
RENEWABLE ENERGY PRODUCED	200 MWH

TOTAL INVESTMENTS	3.1 MILLION EUROS
NO. OF BUILDINGS	18
GUARANTEED ENERGY SAVINGS	60%
PRIMARY ENERGY SAVED	3050 MWH
AVERAGE COST SAVINGS	11%
PRIMARY ENERGY SAVED	620 TONS
RENEWABLE ENERGY PRODUCED	200 MWH

BUILDINGS IN THE METROPOLITAN AREA:
Bruino, None, Orbassano, Piossasco, Volvera

TOTAL INVESTMENTS	7.7 MILLION EUROS
NUMBER OF BUILDINGS	118
EXPECTED ENERGY SAVINGS	30%*
MINIMUM PRIMARY ENERGY SAVED	17,500 MWH
MINIMUM AVOIDED EMISSIONS OF CO_2-eq	3540 TONS

CITY OF TORINO
*Granted savings is 10%, but contractual conditions push the realization of about 30% energy saving

MINIMUM CONTRACT STARTING INVESTMENT	1,7 MILLIONS EUROS
MINIMUM NUMBER OF SPOT LIGHTS TO BE REFURBISHED	2054
MINIMUM CONTRACT STARTING ENERGY SAVINGS	22%-44%
MINIMUM PRIMARY ENERGY SAVINGS	1500 MWH
MINIMUM AVOIDED CO_2-eq EMISSIONS	200 TONS

PUBLIC LIGHTING IN THE METROPOLITAN AREA:
Azeglio, Baldissero Torinese, Bibiana, Bussoleno, Pecetto Torinese, Rivalta Torinese

Figure 1 - 2020TOGETHER Project indicators[3]

Another project that demonstrates a successful way of financing an Energy Efficiency project is INFINITE Solutions - Innovative Financing for Local Sustainable Energy Solutions[4]. The Regional Energy North in Koprivinca, Croatia has a chosen a financial model called Intracting or internal

[3]"20202TOgether, Torino - Horizon2020." [Online]. Available: https://h2020prospect.eu/library/goodpractices/97-20202together-torino
[4]"About Project - Infinite Solutions." [Online]. Available: http://www.rea-sjever.hr/blog/en/about-project.html

contracting. The model is based in the notion of using Energy performance contracting (EPC) between entities owned by the City. It is a combination of Energy revolving fund and Energy service company (ESCO). Between different units of the City administration, a cooperation is established. Financial savings produced as a result of EE measures taken, are returned to a special part of the City budget (Revolving fund), which can be used for new measures and actions. This model is functioning successfully in the city of Stuttgart since 1995. The City of Koprivnica is developing its own version of the model called Internal Energy Revolving Fund (IntERFon).

The most important goals of INFINITE Solutions project were:

- Fundamental innovative financing models of energy efficiency implemented by cities of Stuttgart and Delft (mentors) and redefine and adapt to national framework of cities adaptors (learners);
- Local technical, financial, legal and management capacity building of project partners and their employees;
- National and international (EU) promotion of project results;
- Establishment and implementation of Intracting and Soft Loans in nine cities involved in the project.

4.1.4 Possibilities in the programming period 2021-2027

This Policy Recommendation #3 has multiple impact on the 2021-2027 cohesion policy framework contributing to the achievement of

- PO 1 “Smarter Europe - innovative and smart industrial transformation”
- PO 2 “A greener, low carbon Europe - clean and fair energy transition, green and blue investment, circular economy, climate adaptation and risk prevention”

The inclusion of Green Smart Public Buildings and Smart Public Lighting in national funding schemes, ROPs, RIS3 and local Action Plans will clearly

- promote energy efficiency measures, contributing to SO-b1,
- enhance the industry of smart-green solutions to develop innovative smart energy systems to be implemented in Public Buildings and Public Lighting, contributing to SO-b3 and enhance green infrastructure in the urban environment and pollution reduction, contributing to SO-b7,
- support smart specialization, industrial transition and entrepreneurship by providing relevant funds and intensives in the sectors of Green Smart Public Buildings and Smart Public Lighting, contributing to SO-a4.

Regional development investments will strongly focus the aforementioned POs. A percentage between 65% and 85% will be allocated to these POs depending on the economic status of each Member State.

Barriers

The existing barriers to uphold Green Smart Buildings and Public Lighting initiatives can be classified into four main categories[5]. In the following part each category is associate with corresponding barriers:

- *Information*: Lack of awareness of possible funding sources, lack of awareness and reluctance towards innovative funding mechanisms.
- *Implementation capacity and legislation framework*: lack of human resource and technical know-how by the local authorities
- *Financial and economic*: In this category possible barriers can be insufficient own financial resources, insufficient regional or public funding and high up-front investment cost.
- *Legislation*: The legislation is many times complicated and lengthy with too much room to interpret from the local and regional authorities.

Funding sources in the EU

European funding regarding Green Smart Public Building (SPB) and Smart Public Lighting (SPL) can be classified into different types as illustrated in the following table.

Type	Description
Own	Local or regional funds
National	Funds provided by national organizations or national programmes
European Funds	Funds either managed at EU level (e.g. INTERREG Programmes) or managed at lower level, locally or regionally (e.g. ESIF funds)
Private Funds	Funds that can derive from private contractors, crowdsourcing

European funds

Even though the European union has been supporting the Energy Efficiency (EE) policies for many years, the initial investment cost can act as deterrent factor for stakeholders wanting to uptake

[5]MEDNICE Project, "D. 4.3.1 Technical paper and lessons learned report - MED financing schemes and barriers." 2017

relevant initiatives in the area SPBs or SPL. ÈNERJ[6] project describes possible European funding tools for EE measures in MED area. The following classification is made:

- European Structural and Investment Funds: ERDF, Cohesion Fund;
- European Funding Programs;
- European Project Development Assistance;
- Financial Institutions Instruments;
- Alternative Financing Schemes.

More specifically, the **European Structural and Investment Funds** (ESIF) are the main tools for supporting regional investment policies and providing resources based upon agreed terms between the EU and each member state. The ESIF are channeled to the regions of the member states through Operational Programmes (OPs) which are created after negotiations between EU and the member states or their regions. In these OPs (ROP-Regional Operational Programmes and NOP-National Operational Programmes) the strategic goals and investment priorities are described. One part of ESIF are the ERDF funds which among others are related to projects relevant to EE. Their main beneficiaries are local, regional and national authorities, NGOs, institutions, and SMEs. The type of funding can vary, from grants covering up to 75% of eligible costs, loans, microcredit, guarantees, and other risk-bearing mechanisms. As already mentioned above the majority of ERDF will concentrate on PO1 and PO2 (i.e. smart and green economy).

The Cohesion Fund (CF) is the main financial tool of the EU for reducing economic and social disparities across the member states. It is aimed at member states with Gross National Income per inhabitant less than the 90% of the EU average. For the 2014-2020 CF concerned the following countries Bulgaria, Croatia, Cyprus, the Czech Republic, Estonia, Greece, Hungary, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovakia and Slovenia. It provides funding mainly for environmental and transport infrastructure projects. Concerning the environment, CF supports projects related to EE, low-carbon economy, and sustainable development. The types of funding are loans, guarantees, grants, and equities.

Concerning **European Funding Programmes**, the LIFE programme is the main EU instrument for the environmental and climate actions. The main beneficiaries are public authorities, NGOs and non-profit organizations, and SMEs. The programme is focused on issues of nature conservation and biodiversity, environment and resource efficiency, environmental governance and information, climate change mitigation, climate change adaption, and climate governance and information. The amount of EU contribution for programmes of 1-5 beneficiaries (duration 1-5 years) ranges between 500,00 – 1,500,000 euros and for programmes of 2-10 beneficiaries (duration more than 6 years) ranges between 8,000,000 – 15,000,000 euros. The co-funding rate

[6]ENERJ Project, "D 3.2.2 Funding Tools." 2017

for the period 2014-2017 was 60% while for the period 2017-2020 is 55%. The funding for the capacity building projects for the period 2014-2020 is 100%. The funding comes in the form of grants and the expected outputs of the projects are demos and pilots, reports dissemination activities, capacity building activities, and preparatory projects.

INTERREG Europe fosters the transnational cooperation across Europe. The main beneficiaries are local, regional, and national public authorities, managing authorities/intermediate bodies, agencies, research institutes, and thematic non-profit organizations. The organization must be located inside one of the 27 EU Member States, Norway, Switzerland or the United Kingdom. The thematic areas of interest are research and innovation, low-carbon economy, climate change adaption, SME competitiveness, and environment and resource efficiency. The funds are delivered in the form of grants and the co-funding rate is 85% for all the projects that aim at the priority topics and 74.52% for the projects on the 'technical assistance' axis.

The HORIZON 2020 is the EU 2014-2020 Framework Programme for research and innovation which mainly supports local and regional authorities, pubic bodies, SMEs, researchers, public and private infrastructure operators. Among others it includes relevant focus areas such as public and private building facilities, public lighting, distributed cooling and heating networks, and EE in industry. The co-funding factor is 100% of the eligible costs and the investment must be an amount between 7,500,00 and 50,000,000 million euros.

Regarding **the European Project Development Assistance** initiatives, the Joint Assistance to Support Projects in European Region (JASPERS) aims at improving the quality of investment supported by EU funds. JASPERS partners are the European Commission, the European Investment Bank, and the European Bank for Reconstruction and Development. In the beneficiaries are local, regional, and national authorities and other entities of public interest. The countries that can participate are all the EU Member States and the countries of the Instrument for Pre-Accession Assistance. The areas of interest include water and waste management, infrastructures, promoting smart specialization and smart cities with focusing on sustainable development, urban transport, and EE projects in which Green Smart Public Building can be included. The size of the project has to be above 50,000,000 euros and specifically for transport cases the overall budget of the project must exceed the 75,000,000 euros. The co-funding can be up to 100% of the costs that cover the eligibility criteria.

Another initiative that falls into the previous category of Project Development Assistance initiatives is the European Local Energy Assistance – European Investment Bank (ELENA EIB). Its thematic priorities are the transition to a low-carbon environment, promoting innovation and skills, infrastructures, SMEs, cohesion, and promoting sustainable development. The initiative supports projects above 30,000,000 euros for EE with a 3-year time horizon and 4-year projects of urban transport and mobility. The co-financing rate can reach up to 90% technical assistance/project development costs. There is the possibility of funding smaller projects if they are integrated into larger ones. The leverage factor of these projects needs to be 1:20.

A form of a **Financial Institution Instrument** is the European Fund for Strategic Investments (EFSI). Among others the beneficiaries are public bodies, private companies like large corporations, SMEs, and mid-cap companies, investment platforms, banks, funds and any other form of collective investment vehicles. The Fund finances projects in relevant to PR3 priority areas like smart cities, energy-efficient buildings, investing in a cleaner environment, energy efficiency and tackling climate change, urban regeneration and multi-sector urban infrastructure etc.

The European Investment Bank Municipal Framework Loans are intended for cities of more than 75,000 inhabitants and for a group of countries in which except from the EU Member States additional countries (e.g. Montenegro) are included. This Fund focuses in areas like education, solid wasting, pubic building, energy efficiency, cultural and sport facilities and others. The average size of the investment has to be kept below 50,000,000 euros and the funding is a loan.

The European Energy Efficiency Fund (EEEF) aims to support the goals of EU to promote a sustainable energy market and climate protection. Namely the main three objectives of EEEF are to contribute to the mitigation of climate change, to achieve economic sustainability of the Fund, and to attract private and public capital into climate financing. The beneficiaries include local, municipal and regional authorities, but also and public and private entities acting on behalf of these entities. The range of the direct investments is between 5,000,000 and 25,000,000 euros. The type of financing is loans, guarantees, and equities.

Energy Service Contracting is a type of cooperation between energy service supplier and an end user. According to JRC[7]these contracts can be classified into the following categories:

- Energy Performance Contracting (EPC)
- Energy Supply Contracting (ESC)
- Built-own-operate-transfer

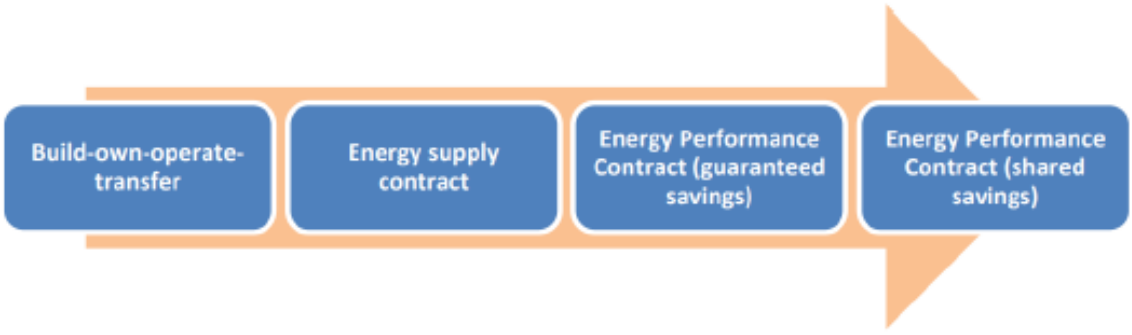

Figure 2 - **Types of energy contracting according to increasing risk from left to right** [2]

[7]Joint Research Centre, "Energy Service Companies in the EU." 2017

The EPC is a contract between a client and an Energy Service Company (ESCO) about EE interventions. The role of the ESCO is to provide the technological knowhow and to monitor the whole process. The EPC-based contracts can be divided into two categories:

- Guaranteed savings EPC: The ESCO if fully responsible for designing, implementing and monitoring the project. The client does not have worry about the performance.
- Shared savings EPC: The savings are split according to agreed percentages.

In ESC case the client usually is an energy supplier typically in the form of heat. In this cases ESCO provides energy to the client and aims at reducing the supply costs. For example, it can apply measures like optimizing the equipment or introducing smart devices for optimizing the functionality.

Finally, under Built-own-operate-transfer contract design, builds, operates and funds the projects only for a limited time period. The clients are charged according to the service.

	EPC - Guaranteed savings model	EPC - Shared Savings model	Energy Supply Contracting (ESC)
Service provider	ESCO/EPC provider	ESCO	Energy Supply Provider Company (ESPC)
Key elements	Implementation of energy saving measures with on-going monitoring & verification services to provide guaranteed energy savings.	Implementation of energy saving measures (mainly demand side) to provide cost savings associated with the overall energy/utility bill.	Efficient supply of useful energy such as heat, steam or electricity is contracted, measured and delivered in physical units.
Energy savings to be achieved	High - comprehensive and detailed approach covering both supply and demand side.	High - primary focus and incentive is for cost savings with technical operation requirements as secondary.	Usually low - limited to the supply side (boilers, chillers, etc.) without regard to demand- side equipment.
Guarantees	Yes. The ESCO guarantees the performance related to the level of energy saved throughout the contract life (i.e. to energy cost savings in constant prices).	Not as standard. However, the ESCO may guarantee a minimum performance related to cost of energy saved in current prices throughout the contract life.	May include incentives related to energy use reduction on the supply side, but without assuming any risk in case the expected efficiency improvement is not reached.
Payment	Payment derived from the energy savings achieved in constant prices of the base year.	Payment linked to the achieved change in energy costs.	Payment of a fixed rate/tariff, normally without energy performance requirements.
Provider's risk	Assumes technical design, implementation and performance guarantee risks.	Assumes performance risk, risk of energy price change (depends on current prices) and customer credit risk.	Usually does not assume technical or financial risk.
Energy savings transparency	The energy consumption is measured before and after the measures are implemented. The transparency depends on the quality of measurement & verification. In general the more independent M&V, the more transparent are the energy savings.	Depends whether and what quality M&V is provided. In general, the more independent M&V, the more transparent are the energy savings.	Low - a specific energy bill reduction is established (in monetary, not physical units). Usually the contract does not take into account the measurement of the energy efficiency.

Figure 3 - **Basic characteristics of EPCs and ESC**[8]

[8]Joint Research Centre, "Energy Service Companies in the EU." 2017

A number of **Alternative financing schemes** can be utilities for raising funds for implementing the relevant initiatives. Some of them are described in the following list:

- Soft loans. Soft loan schemes (below market rates and with longer payback periods).
- Revolving Loan funds. A revolving loan fund is a fund which its source is a number of sustainable energy projects. These funds can provide loans to projects without access to financing or provide loans with low rates.
- Crowd-funding platforms. This kind of funding comes from multiple and various sources and usually internet-based platforms are used for raising funds.
- On-bill financing. Energy suppliers collect the money for repaying a loan via the energy bills.
- Green municipal bonds. Local or regional governments can issue bonds for financing sustainable energy projects.

4.1.5 Indicators on feedback to gather from policy makers

Among the key requirements and the expected results of the training sessions is not only to give the necessary information to the policy makers, but also to gather and acquire all the relevant data that will help us to formulate a better understanding about the capacity and the capabilities of the participants. Therefore, for each stakeholder the following information has to be gathered:

- Types of different funding schemes utilized during the 2007-2013 period;
- Amount of money raised utilizing different financing mechanisms;
- Number of local, regional, national or EU projects that his organization has participated in as a partner;
- Number of local, regional, national or EU projects that his organization has participated in as a lead partner;
- Number of staff that has an experience in taking part in relevant actions.

4.2 Policy Recommendation #6: Compulsory adoption and use of EU GPP criteria from national and regional public authorities

4.2.1 Description

Public authorities are currently the largest consumers in Europe, with annual expenditure of approximately 1.8 trillion euro annually, representing around 14% of the European gross domestic product. Thus, by using their purchasing power to choose goods and services with a low environmental impact, they can make an important contribution to sustainable production and consumption. Some member states have already developed Action Plans for the adoption of the EUGGP criteria at national and regional level and/or have defined minimum environmental criteria.

However, the adoption and use of the EU GPP criteria should be defined as compulsory when national and regional public authorities procure goods and services. The compulsory use should be defined by national and regional Action Plans, and adjustment based on state and region needs should be taken into account.

4.2.2 2014-2020 Framework

The Green Public Procurement (GPP) is based on the general legal framework on public procurements that is presented below:

- Directive 2004/17/EC of 31 March 2004 on coordinating the procurement procedures of entities operating in the water, energy, transport and postal services sectors.
- Directive 2004/18/EC of 31 March 2004 on the coordination of procedures for the award of public works contracts, public supply contracts and public service contracts.

A set of more specific directives aimed at green procurement procedures has been proposed and taken effect since 2014. The directives are listed below:

- Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014, on public procurement and repealing Directive 2004/18/EC.
- Directive 2014/25/EU of the European Parliament and of the Council of 26 February 2014, on procurement by entities operating in the water, energy, transport and postal services sectors and repealing Directive 2004/17/EC.

- Directive 2014/23/EU of the European Parliament and of the Council of 26 February 2014, on the award of concession contracts.

In 2003, the European Commission in its Communication on Integrated Product Policy (IPP) has indicted Member States to draw up publicly available National Action Plans (NAPs) with ambitious targets for raising awareness and greening their public procurement. The NAPs should contain an assessment of the existing situation and ambitious targets for the next three years, specifying what measures will be taken to achieve them. The NAPs are not legally-binding but provide political impetus to the process of implementing and raising awareness of greener public procurement.

Having environmental contract clauses is only effective if compliance with these clauses is properly monitored. Different forms of contract compliance monitoring can be applied, such as the supplementation of evidence of compliance, the contracting authority could perform spot checks, or a third party could take over the compliance monitoring through specific contracts. Appropriate penalties for non-compliance or bonuses for good performance should be included within the contract. For example, many contracting authorities include key performance indicators (KPIs) in contracts, which can be linked to the contractor's entitlement to claim payment. As good performance on environmental issues also helps to establish a contractor's reputation, incentives may take the form of positive publicity which highlights this to the public and other contracting authorities. If a contract includes elements of subcontracting, you will want to ensure that GPP commitments are enforced along the supply chain and that responsibility is clearly assigned. The 2014 directives provide new opportunities for oversight of subcontracting arrangements, including the ability to require joint liability of the main contractor and any subcontractors for compliance with environmental obligations if provided for in national law, and require the replacement of a subcontractor where its compliance with environmental obligations cannot be verified.

Out of the 27 Member States, 22 have already implemented in their national legislation a National Action Plan or other relative document regarding green public procurement procedures. For example, Italy has adopted a NAP by Ministerial Decree of 11th April 2008, which has been revised by Ministerial Decree of 10th April 2013. Under art. 34 of the Legislative Decree 50/2016 on public procurement and concessions, as amended by art. 23 of the Legislative Decree 56/2017, the application of the Minimum Environmental Criteria set within the GPP NAP is mandatory for all kind of contracting authorities, for the whole value of the tender, and also for procurement below the threshold amounts fixed by the Directives on public procurement and concessions. Furthermore, under the same articles, the introduction of at least the technical specifications and the contract clauses of the Minimum Environmental Criteria is obligatory in tender documents, regardless of their value, so also for procurements below the threshold amounts. Also, the award criteria must be taken into account when a contracting authority awards the contract with the best quality price ratio. Some of the criteria mentioned, include quality (merit, functional characteristics, accessibility, certifications), holding an EU eco-label in relation to goods or services covered by the contract, cost of use and maintenance, compensation of greenhouse effect gas

emissions associated with the company's activities calculated according to the methods established on the basis of recommendation no. 2013/179/EU, organization, qualifications and experience of the staff actually used in the contract, if the quality of the personnel in charge can have a significant influence on the level of performance of the contract, after-sales service and technical assistance and conditions of delivery or execution of the service.

The evaluation criteria defined by the contracting authority also take into account the minimum environmental criteria (CAM). By applying the CAM as minimum criteria (threshold) to have a Green Public Procurement the most economically advantageous tender (M.E.A.T.) criterion can be respected by using the L.C.C. (life cycle cost). The Life Cycle Cost is a powerful environmental assessment tool, which can be used as a M.E.A.T. criterion with precise economic and environmental considerations on the procurement cycle.

In Spain, at State level, policy is designed by Inter-ministerial Commission, headed by the Ministry of Agriculture, Food & Environment and the Ministry of Finance and is implemented by all the ministries. The Green Public Procurement Plan of the State General Administration and its Public Entities and the Managing Bodies of the Social Security was approved the 21st January 2008 and published in the B.O.E the 31st January 2008. At sub-national level in Catalonia the Government Measure and Decree for Responsible Public Procurement with Social and Environmental Criteria was voted in 2013 while in 2015 the local authorities voted the decree approving the procedure for implementation of environmental criteria according to the provisions of the 2-13 Decree (Mandatory use of the environmental criteria developed by the Government + sustainable programme). As well in Andalusia the agreement of the Government Council of September 4, 2018, which approves the Strategy for the promotion and consolidation of the Public Procurement of Innovation in the Public Administration of the Andalusian Government and Agreement of February 6, 2018, of the Council Government, which approves the formulation of the 2020 Strategy for promoting and consolidating public purchase of innovation in the Administration of the Andalusian Government are the ones promoting innovative public procurement in the region. National criteria on GPP have been put in place on several product categories including energy.

In Greece, the achievement of sustainability is a target of utilization of different investment funds. In the period 2014-2020 main targets of public funding in Greece were job creation, increase of competitiveness, protection of the environment, and contribution to the move to the economy of low carbon emissions, as well as enhancing infrastructure of transport and transfer of energy. One of the greatest budgetary and investment priorities, refer to the protection of the environment and an eco-friendly economy. In Greece, the percentage of contracts that are compliant with the green procurement criteria is below 20%, below the ambitious set goal of 50%. National Greek Green Public Procurement plan is still being elaborated. Yet, Greek Presidential Decrees (60/2007, 59/2007) have included many environmental views, and with the European Directives and Regulations, the Greek public authorities have become stricter, especially in the field of their energy performance of public and private contracts for procurement of buildings, and green electricity among other areas.

4.2.3 Successful local Experiences

Green Procurement in Badalona's Schools

A success story regarding the European Union's G.P.P. criteria, is the Green Procurement that took place in the schools of Badalona. Badalona is a Spanish city, one of the biggest cities in the province of Catalonia, and maintains almost a decade of successful implementation and experience of Green Public Procurement. The first project to encourage G.P.P. in public schools started in 2009, with the immediate support of Barcelona's Ecoinstitut. The project maintained an objective: to spread GPP knowledge and best practices to every city's school that participated.

More specifically, six schools were chosen to participate in a project whose objective was to analyze and develop guidelines through best practices for the green procurement of five product groups: school materials, building maintenance, cleaning, food and IT products. Furthermore, a kit of green school materials was made available by the City Council to all of the schools that participated, if they demanded them, as well as for potential other school that did not take place in the GPP project, in the possibility of wanting to find out more information about GPP.

The consumption and procurement habits for each of the five product groups were gathered through questionnaires and numerous personal interviews, and were afterwards analyzed for each school separately. Depending on the gathered information, a detailed procurement and user guidance were developed for each of the five product groups at hand.

The procurement of the paper group pertained a 100% recycled and totally chlorine free for plain papers and usage of sustainably certified harvested virgin fibers for colored paper. They also reduced the consumption by re-utilizing papers for taking notes as well as double-sided copying as mere examples. The IT Product group made sure to recycle toner and ink-jet cartridges and maintained energy efficient equipment based on the guidelines of Energy Star criteria. As a result, the printing was reduced, and energy was saved by switching off monitors when they are temporarily not in use or the computers are in sleep mode. Also, obsolete and old equipment was donated for recycling to Non-Government Organizations who are working on social inclusion projects. The food and catering group purchased food produced through organic agriculture and adapted menus with less meat and more seasonal food, as their means of procurement. Also, they avoided using plastic equipment such as cutlery or plates, and set up a school garden for vegetables, for educational as well as culinary purposes. The cleaning and waste group purchased environmentally friendly cleaning products which were based on the EU Green Public Procurement Toolkit and Procura+ Campaign criteria, following a test phase, and set up a waste collection policy as well. For the building maintenance group, environmental criteria for contracting maintenance services were included, as well as targeting behavior such as switching off lights when leaving rooms.

The results and environmental impacts of the Badalona's Schools' GPP were evident, mostly in the saving of 9,574 liters of water and 2,048 kWh in energy annually, through the purchases of 100% recycles paper. New farming methods and environmentally friendly usage of materials in food cultivation and processing played an important role, and was a strong factor for GPP as well as the guideline-compliant cleaning products which helped reduce bio-accumulation and air pollution only to name a few green upgrades. The greatest difficulty of the experiment was determining the actors and dispersing them throughout the project. For each different group, the responsibility of defining the requirements was divided between the following stakeholders: regional authorities, the city council, as well as each participating school. The school community was also immediately involved in the purchasing process of each component for the green public procurement, and this process is considered vital for the successful implementation of the aforementioned measures and procedures that took place in the schools of Badalona.

Green Electricity and Vehicles – Slovenia

Slovenia as a country maintained a National Action Plan for Green Public Procurement, which had set a target for 50% of all procurement by central government authorities in eight product groups to include green public procurement criteria. For electricity, the target is 100% green procurement, reflecting the availability of hydroelectric and biomass (wood) energy sources. The strategy also includes training on Green Public Procurement, pilot projects and assisting public authorities in attaining third-party certified environmental management systems.

The Public Procurement Agency in Slovenia is responsible for carrying out joint procurements for Slovenian public authorities for a number of product and service groups. This agency also implements Green Public Procurement criteria in terms of electricity, paper, office IT equipment and vehicles. There has been also work done by the Ministry of Public Administration to introduce Green Public Procurement as a focal point of purchasing in the region of Slovenia. The agency also purchases on behalf of more than one hundred authorities across the Slovenian public sector.

Regarding the criteria used, as long as the supply of electricity is concerned, a great portion of the electricity supplied amongst the numbers of 30%, must be produced through a green way, by renewable sources or cogeneration of heat and electricity with high efficiency measures, which is widely called "green electricity". The award criteria depends on the most economically advantageous tender (M.E.A.T.), in terms of price (96.1 points) and the percentage of green electricity that is presented above the minimum. Given that the 30% is obligatory, 0,15 points are given for each additional percentage of green electricity, which adds up to a 3.9 total points, even if the sum of percentages transcends it. For the verification of the performance clauses and the evaluation of compliance with GPP specifications and award criteria regarding the supply of green

electricity, a declaration from the supplier is required. Guarantees of Origin will be required 12 months after the entry into force of the contract, to establish that the percentage of green electricity has been delivered.

For serving vehicles and their technical specifications, for most types except the cargo vans, all vehicles must meet the EURO 5 emissions standard or similarly. There is also a threshold for maximum CO2 emissions, which ranges from 115 g/km for small cars and can go up to 180 g/km for larger vehicles such as mini-buses, whose size can explain the emissions, and lowering them more is deemed almost impossible with current technology. The award criteria again pertain the Most Economically Advantageous Tender, and their points are divided as such: 81 points for the operational lifetime costs, 5 points for the Service network, 4 points for the safety and environmental equipment, 1 point for gear shift indicator, 4 points for warranty period, 3 points for delivery time, and two points for tyre pressure monitor.

The results for the supply of electricity were gathered from the information of over 120 public authorities, and the estimated annual consumption of electricity was about 35 million kWh. The five bidders that participated offered at least the required percentage of “green electricity”, two of them offered 60% of “green electricity” and one of these two was selected as the winning bidder accordingly.

For the supply of vehicles, applying operational LCC (life-cycle costing) as a part of the award criteria on one hand, and setting requirements for the maximum levels of CO2 emissions that are released on the other hand, made contractors create and submit offers for vehicles that have lower CO2 emissions. The outcome of taking CO2 emissions and other pollutants into consideration can be seen by comparing the emissions of the vehicles from the previous year. A decrease in emissions was pinpointed in comparison in the types of vehicles, which ranged between 3g/km to 45 g/km per participating vehicle.

For the environmental impacts of the GPP incentive that took place in Slovenia, the CO2 emissions are traditionally correlated with fossil fuel-based electricity generation. Thus, the use of renewable energies in the electricity sector is one of the most effective measures for achieving climate protection goals, in addition to reducing electricity consumption levels. The combination of heat and power which is known as “Cogeneration” is an environmentally friendly way to deliver electricity, especially when criteria that involve generation efficiency are applied. A common framework for assessing the efficiency of cogeneration is provided in Directive 2004/8/EC and Decision 2007/74/EC. Regarding the environmental impact of vehicles and transport, vehicles are responsible for the 26% of EU final energy consumption and 24% of CO2 emissions. It is imperative to further the development and deployment of new and better environmental technologies for public vehicles as part of the solution to these issues. The Clean Vehicles Directive provides a common methodology for taking greenhouse gas emissions and energy consumption into account in the procurement of road transport vehicles.

4.2.4 Possibilities in the programming period 2021-2027

The funding of EU's eco-innovation is abundantly evident in the next Horizon's Cohesion Policy which will take place in the period range from 2021 to 2027. The spending program of the European Union has always been centered around environmental approaches, while allocating "green" funds accordingly, and this approach will continue with the 2021-2027 budgetary period's spending program.

With the current proposals in regards to funding, the eco-innovation environmental agenda of EU gains a great financial support, even greater than previous years, and currently possesses an even larger share of the funding under the main programmes such as Horizon Europe. Horizon Europe will have 3 Pillars, including 'Global Challenges and Industrial Competitiveness', which is earmarked to receive EUR 52.7 billion, which consists of more than half of the total innovation budget and research budget respectively. EU's new green program will emphasize the mission-oriented policy support meaning setting precise goals and aiming to achieve them through funding research. Many of the missions (replacing the current societal challenges) will have an eco-innovation and circular economy dimension along with the aforementioned adopted decoupling agenda.

The European Union agenda has also catered to more regional needs in its 2021-2027 spending action plans, whereas the next Cohesion Fund will greatly correlate with regional development. More specifically, a significant share of European Regional Development Fund and Cohesion Fund investments will go towards innovation, support to small businesses, digital technologies and industrial modernization. Also, this spending plan will be centered around ashift towards a low-carbon, circular economy and the fight against climate change. In addition, the post-2020 period has been analyzed in one of the platform's articles on Environment in the post-2020 Cohesion policy. The LIFE+ program has been a major source for funding for green eco-innovation.

In the upcoming programming period after 2021 the Commission intends to allocate EUR 5.450 billion to projects supporting the environment and climate action which is an increase by EUR 1.950 billion. This funding is split as follows: Nature and biodiversity (EUR 2.150 billion); Circular economy and quality of life (EUR 1.350 billion); Climate change mitigation and adaptation (EUR 0.950 billion); Clean energy transition (EUR 1 billion). Practice has demonstrated that regions, especially in bigger Member States, are the right governance level to provide support to companies and organizations for adopting eco-innovative solutions. This is because regions dispose of significant budgets – both own budget and ESIF. They are also close to the SMEs and can impact the company ecosystem in an efficient manner. However, many regions do not possess the drive, the political commitment or the resources to provide this support. This is due to many reasons including eco-innovation not being high on the national agenda, insufficient regional budgets, competing priorities, insufficient human resources in the regional administrations, etc. Eco-innovative solutions for companies are often complex and also technology- and knowledge

intensive. While big companies may afford the investments in human resource related to eco-innovation, SMEs need access to competent solutions. Regional authorities are often short of skills and know-how for adopting eco-innovative solutions or for stimulating SMEs in adopting these. For example, Green Public Procurement (GPP) is a complex organizational approach which needs legal basis, knowledgeable public servants, a market for green products, etc.

4.2.5 Indicators on feedback to gather from policy makers

An objective of the training to be carried out by the Esmartcity project is the gathering of feedback by the participating policy makers on the selected policy recommendation. Below are some suggested indicators on the required feedback:

- level of organization staff expertise for involvement in GPP projects,
- cost of required training for organization staff,
- changes required in organization procedures for adaptation to new public procurement procedures,
- level of SME preparedness for involvement in GPP projects,
- level of public awareness on new public procurement procedures,
- ease of access to funding tools,
- available national legislation,
- level of complexity of new procurement procedures,
- tools and easiness to monitor GPP contract compliance.

4.3 Policy Recommendation #9: Funding the implementation of PPI and PCP through national funding schemes, ROPs and RIS3

4.3.1 Description

Policy recommendation #9 concerns funding the implementation of PPI (Public Procurement of Innovative solutions) and PCP (Pre-Commercial Procurement) through national funding schemes, ROPs and RIS3.

Public Procurement of Innovative solutions (PPI) provides a large enough demand to incentivize industry to invest in wide commercialization to bring innovative solutions to the market with the quality and price needed for mass market deployment. This enables the public sector to modernize public services with better value for money solutions and provides growth opportunities for companies. The idea behind PPI is that the public sector uses its purchasing power to act as early adopter of innovative solutions which are not yet available on large scale commercial basis. This is done through creating the necessary demand of innovative products by utilizing the purchasing power of public procurers to drive industry towards producing solutions not already available.

Pre-Commercial Procurement (PCP) challenges industry to develop innovative solutions for public sector needs and it provides a first customer reference that enables companies to create competitive advantage on the market. PCP enables public procurers to compare alternative potential solution approaches and filter out the best possible solutions that the market can deliver to address the public need. Therefore, PCP is regarded as an important tool to stimulate innovation as it enables the public sector to steer the development of new solutions directly towards its needs.

As a result, PPI and PCP enable public procurers to drive innovation from the demand side by acting as technologically demanding customers that buy the development and testing of new solutions; thus, covering society's needs with better solutions, while providing growth opportunities for companies.

Public procurement now accounts for some 14% of GDP in the European Union, representing an enormous potential market for innovative products and services, offering a powerful leverage for the modernization of public sector and for the competitiveness and growth of European industry. Through the adoption of PPI and PCP there are benefits both for the procurer and the supplier. The procurers have the chance to steer the development of innovative solutions towards the specific needs of the public sector from the earliest phases of R&D, leading to solutions that address the societal challenges of the future. Moreover, this is achieved with the lowest possible cost by avoiding market fragmentation. On the other side, suppliers have the opportunity to

collaborate with the procurers in order to achieve breakthrough innovations that will put them in key positions to address the future market, and this can be done by receiving public funding, thus reducing the involved risk.

With all the above taken into account, it would seem logical that PPI and PCP would be extensively adopted by the European public sector. However, PPI and PCP procedures are not yet common practice among public authorities, since they demand a lot of effort and time from the side of public procurers. Also, the lack of experience worsens the situation. To overcome these difficulties, the implementation of PPI and PCP should be included in national funding schemes, ROPs and RIS3. New taxes incentives for enterprises involved in such procedures would also contribute to the implementation of PPI and PCP.

The present policy recommendation aims at providing information on the available legal frameworks and funding tools related to PPI and PCP. The goal is to increase the number of public procurers implementing PPI and/or PCP projects, and making the use of these new procedures more widespread in all possible areas where a public procurement process involving innovation is required.

4.3.2 2014-2020 Framework

The PPI and PCP procedures are part of the wider in scope Green Public Procurement (GPP). Therefore, there is a common legal framework concerning both PPI and PCP. The general framework on public procurements is presented below:

- Directive 2004/17/EC of 31 March 2004 on coordinating the procurement procedures of entities operating in the water, energy, transport and postal services sectors.
- Directive 2004/18/EC of 31 March 2004 on the coordination of procedures for the award of public works contracts, public supply contracts and public service contracts.

A set of more specific directives aimed at green procurement procedures has been proposed and taken effect since 2014. The directives are listed below:

- Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014, on public procurement and repealing Directive 2004/18/EC.
- Directive 2014/25/EU of the European Parliament and of the Council of 26 February 2014, on procurement by entities operating in the water, energy, transport and postal services sectors and repealing Directive 2004/17/EC.
- Directive 2014/23/EU of the European Parliament and of the Council of 26 February 2014, on the award of concession contracts.

In 2003, the European Commission in its Communication on Integrated Product Policy (IPP) encouraged Member States to draw up publicly available National Action Plans (NAPs) for greening their public procurement. The NAPs should contain an assessment of the existing situation and ambitious targets for the next three years, specifying what measures will be taken to achieve them. The NAPs are not legally-binding but provide political impetus to the process of implementing and raising awareness of greener public procurement.

Out of the 27 Member States, 22 have already implemented in their national legislation a National Action Plan or other relative document regarding green public procurement procedures. For example, Italy has adopted a NAP by Ministerial Decree of 11th April 2008, which has been revised by Ministerial Decree of 10th April 2013.Under art. 34 of the Legislative Decree 50/2016 on public procurement and concessions, as amended by art. 23 of the Legislative Decree 56/2017, the application of the Minimum Environmental Criteria set within the GPP NAP is mandatory for all kind of contracting authorities, for the whole value of the tender, and also for procurement below the threshold amounts fixed by the Directives on public procurement and concessions. Furthermore, under the same articles, the introduction of at least the technical specifications and the contract clauses of the Minimum Environmental Criteria is obligatory in tender documents, regardless of their value, so also for procurements below the threshold amounts. Also, the award criteria must be taken into account when a contracting authority awards the contract with the best quality price ratio.

In Spain, at State level, policy is designed by Inter-ministerial Commission, headed by the Ministry of Agriculture, Food & Environment and the Ministry of Finance and is implemented by all the ministries. The Green Public Procurement Plan of the State General Administration and its Public Entities and the Managing Bodies of the Social Security was approved the 21st January 2008 and published in the B.O.E the 31st January 2008. At sub-national level in Catalonia the Government Measure and Decree for Responsible Public Procurement with Social and Environmental Criteria was voted in 2013 while in 2015 the local authorities voted the decree approving the procedure for implementation of environmental criteria according to the provisions of the 2-13 Decree (Mandatory use of the environmental criteria developed by the Government + sustainable programme). As well in Andalusia the agreement of the Government Council of September 4, 2018, which approves the Strategy for the promotion and consolidation of the Public Procurement of Innovation in the Public Administration of the Andalusian Government and Agreement of February 6, 2018, of the Council Government, which approves the formulation of the 2020 Strategy for promoting and consolidating public purchase of innovation in the Administration of the Andalusian Government are the ones promoting innovative public procurement in the region. National criteria on GPP have been put in place on several product categories including energy.

Since 2009, the Commission has co-financed via Framework Programme 7 the establishment of networks of public procurers to prepare the ground for launching PPIs. Since 2013, the Commission is also co-financing, via Critical Infrastructure Protection and Horizon 2020, public procurers from different European countries to undertake together PPIs on topics of common

interest. Criteria for public procurement procedures have been developed at national level for a number of product groups, including street lighting and energy services for buildings.

The Horizon 2020 Access to Risk Finance work programme provides, in cooperation with European Investment Bank and European Investment Fund, loans for individual or groups of public procurers to start PPIs (Innovfin large projects) and helps companies that are involved in PPIs to gain easier access to loans, guarantees, counter-guarantees, hybrid, mezzanine and equity finance to grow their business in view of wider commercialization of solutions (Innovfin for innovators).

Moreover, the European Assistance for Innovation Procurement Initiative provides free of charge technical and legal assistance to individual procurers to implement PCPs and PPIs.

4.3.3 Successful local Experiences

Several projects aimed at utilizing PPI and PCP procedures have been funded by the EU. The aim of this chapter is to present successful experiences at local level on the implementation of the specific policy recommendation that can be used as good practices. Where possible, their measurable results are indicated.

Project **Select4Cities** was built around the premise that cities across the world are seeking new methods, technology and tools to foster open innovation to solve challenges, create value for their citizens and business, and to become 'smart cities'.

Internet of Everything (IoE) is one of the dominant drivers transforming the way people manage and live in urban environments. This new connected approach involves physical spaces as well as objects and provides a massive opportunity for the creation of new smart services and businesses especially in the areas of logistics, transport, environment, security and wellbeing. However, IoE progress to date has been slow due to a number of barriers such as the lack of common standards, a fragmented marketplace, and lack of ways to systematically test and introduce new solutions in the cities.

To combat this challenge, and accelerate innovation, the SELECT project laid forth a competition open to all European companies to develop an open, standardized, data-driven, service-oriented and user-centric platform that enables large-scale co-creation, testing and validation of urban IoE applications and services.

The result of the project was the creation of several digital platforms aiming at connecting the various cities IoT systems helping them become a large-scale de-facto Internet of Everything (IoE) Lab. These solutions were validated based on the use-cases through real-life living lab scenarios. The project also provided useful information on the difficulties while implementing PCP procedures, leading to a list of recommendations for improving the current procedures.

Project **Procure2Innovate** will improve institutional support for public procurers purchasing information and communication technologies (ICT), as well as acquiring products and services from a range of sectors that implement innovation procurement. The project will establish or expand competence centers for innovation procurement in 10 European Union countries.

A competence center on innovation procurement is an organisation/organisational structure that has been assigned the task by its government and has a mandate according to national law to encourage wider use of pre-commercial procurement (PCP) and public procurement of innovation (PPI) that includes among others providing practical and/or financial assistance to public procurers in the preparation and/or implementation of PCP and PPI across all sectors of public interest.

Funded by the European Commission through the Horizon 2020 research and innovation programme, Procure2Innovate will:

- Build a permanent network of competence centres that will facilitate knowledge sharing, collaboration and the exchange of best practices.
- Support (at least) five existing innovation procurement competence centres to enlarge their scope, increase their impact, and enhance their services for public procurers.
- Establish five new innovation procurement competence centres, helping them to support public procurers as they become ever more established and experienced in the field.
- Spur mainstreaming PCP and PPI across Europe
- Support all competence centres to develop expertise in cross-border co-operation and joint procurement.
- Communicate and disseminate the tools and approaches (and results) developed by Procure2Innovate competence centres at a European level. This is key to making innovation procurement knowledge accessible to more public procurers and other stakeholders.

Already established competence centers drive towards more concerted national efforts towards effective innovation procurement procedures, and with the goal of providing better access for public and private companies, especially in the fields of information and communication technologies (ICT).

4.3.4 Possibilities in the programming period 2021-2027

The revised EU Cohesion Policy 2021-2027 outlines the specific policy objectives to be supported by the ERDF and CF. These policy objectives replace the 11 thematic objectives of the 2014-2020 programming period and are listed below:

1. a smarter Europe – innovative and smart industrial transformation;
2. a greener, low carbon Europe – clean and fair energy transition, green and blue investment, circular economy, climate adaptation and risk prevention;
3. a more connected Europe – mobility and regional ICT connectivity;
4. a more social Europe – implementing the European Pillar of Social Rights;
5. Europe closer to citizens – sustainable and integrated development of urban, rural and coastal areas through local initiatives

The ERDF funds all five objectives, with an emphasis on PO 1 and 2. On the other hand CF funds objectives 2 and 3, focusing environment and transport.

The selected policy recommendation is related to Policy Objective 1, Smarter Europe -innovative and smart industrial transformation. More specifically it is relevant to the following specific objectives:

- a1: Strengthen research and innovation capacities and the introduction of advanced technologies;
- a3: Strengthen the growth and competitiveness of SMEs;
- a4: Develop skills for smart specialization, industrial transition and entrepreneurship.

Since the recommendation is related to PO1, it is clear that funding will be available through the ERDF. INTERREG will continue to be supported by the ERDF. In this context, for regions with matching 'smart specialisation' assets, pan-European clusters will be built in priority sectors under a new interregional instrument aimed at ‘helping those involved in smart specialisation strategies (S3) to cluster together, in order to scale up innovation and bring innovative products and processes to the European market’.

New financial instruments are also made available for public stakeholders, which have a leverage effect and are closer to the market. For example, Member States will be able to transfer a part of their Cohesion Policy resources to the new, centrally managed InvestEU fund, to access the guarantee provided by the EU budget.

4.3.5 Indicators on feedback to gather from policy makers

An objective of the training to be carried out by the Esmartcity project is the gathering of feedback by the participating policy makers on the selected policy recommendation. Below are some suggested indicators on the required feedback:

- level of organization staff expertise for involvement in PPI/PCP projects,
- cost of required training for organization staff,
- changes required in organization procedures for adaptation to new public procurement procedures,
- level of SME preparedness for involvement in PPI/PCP projects,
- level of public awareness on new public procurement procedures,
- ease of access to funding tools,
- available national legislation,
- level of complexity of new procurement procedures,
- tools and easiness to monitor GPP contract compliance.

5 Successful Experiences

This chapter details some successful experiences on public lighting and on public buildings that could be used for the purposes of the training.

5.1 Community Energy Management System in Yokohama, Japan

The city of Yokohama, in Japan, introduced a Community Energy Management System to achieve efficient energy management, including the installation of emergency management systems in 4,200 homes, the introduction of 2,300 electric vehicles and of 37 MW of photovoltaic generation, leading to the reduction of 39,000 tons of CO2 emissions.

5.2 The Edge, Amsterdam

The Edge is an office building in Amsterdam, the Netherlands, that showcases the benefits of Building Information Modeling (BIM). Completed in November 2014, The Edge was built with the Internet of Things (IoT) as its foundational principle. Its design and construction did not use BIM in the prescribed sense but its implementation of smart technologies enables The Edge to achieve many of BIM's benefits and it perhaps even serves as an exemplar for a few. Some of these are: automated energy performance visualization, building usage monitoring and post-processing for energy analysis. Since its completion, The Edge has been internationally admired as one of the smartest buildings in the world and has also been called a computer with a roof. However, the success of The Edge goes beyond its use of cutting-edge technologies and instead lies in effective communication between key drivers (Deloitte, OVG Real Estate, PLP Architecture, Philips, Mapiq and Schneider Electric)who championed diverse and original ideas. This building is forecasted to save 42 million kilograms of CO2 during its first 10 years' operation, compared to a normal office building, and the estimated energy consumption varies between -0.3 and 40.7 kWh/m2/year depending on the availability of the renewable energy supply by the PV production.

5.3 Duke Energy Center, Charlotte, NC

A good example of a smart building in action is the Duke Energy Center, a LEED Platinum 48-story office tower located in Charlotte, NC. Owned by Wells Fargo & Co., the Duke Energy Center was

chosen in 2010 as a grand prize winner of the inaugural Siemens Smartest Building in America Challenge. In the Duke Energy Center, 16 separate building systems, including three building automation systems, are integrated through one routed Internet Protocol network. The 1.5 millionsq.ft. office building also has a Tier IV data center. The complex building automation system was customized to accommodate multiple protocols (BACnet, OPC, LonWorks, Modbus and PLC) to allow for efficient system operation and data collection from diverse building systems. Integrated systems in the center include lighting controls inside and outside of the building, light harvesting blinds, seven 2.25-MW generators and several uninterruptible power supply systems. The center also integrates elevator monitoring, video surveillance from 200 security cameras, emergency intercom systems, digital signage, parking access and revenue control (PARC) system, even a custom underground water filtration system.

5.4 Veghel behind a digital city wall

The municipality of Veghel, the Netherlands initiated a project entitled “Veghel behind a digital city wall” to decrease the effect of online shopping in the city. In this case, Philips Lighting developed a two-step plan. First, it sought to create a lighting experience area, where colorful, dynamic lighting scenarios welcome and attract visitors to the city center. Second, they created an experience platform with an interactive lighting design for the two main shopping streets, initiating the project “Veghel turns the light on”. The focus for the experience platform lays on changing lighting content that could invoke particular experiences in the city center. More specifically, Philips Lighting conducted an area analysis and designed both the luminaires as well as the lighting content for different atmospheres. Such lighting experiences improve the visibility of retailers in the city center;it also stabilizes the bond between the city and its citizens and attracts new visitors. By offering products and services (lighting consultancy,experience platform, and maintenance), Philips Lighting was able to diversify its revenue opportunities. The initial results look promising: there are 22 newly opened shops and 15% more visitors in the city center.

5.5 Intelligent lighting in Helmond, the Netherlands

Tvilight provided the city of Helmond, in the Netherlands, with its cutting-edge connected intelligent lighting solution, which includes award-winning street light sensors and wireless lighting controllers capable of adjusting the level of illumination based on real-time human presence. In addition to innovative smart lighting solution, Tvilight offered intuitive, feature-rich light management software which allows the Helmond municipality to collect valuable statistics, such as citizens’ activity and energy consumption, creating light profiles that match the illumination requirements of each particular location in the city.

5.6 Smart city lighting in Jaipur, India

Revolutionary smart street light sensors and versatile lighting controllers from Tvilight enable the 'Pink City' Jaipur, in India, to reduce energy consumption, 72% energy savingsand thereby minimize CO2 emissions and light pollution; lower maintenance costs; improve safety and quality of life of the citizens; taking a leap towards becoming one of the forefront smart cities in the country.Tvilight's smart street lighting works on Open API; hence, the integration with third-party smart city management software (Cisco Kinetic) and luminaries (Bajaj Electricals) was also easy.

5.7 GPP for indoor lighting at the University of Patras, Greece

The existent lighting bulbs used in the Cultural Center and the Polytechnic Amphitheater of the University of Patras were energy-intensive, demanding a high maintenance and replacement cost and offering a relatively short lifetime. As a result, it was deemed necessary to adopt a practice that would provide beneficial results for the sustainability of the environment, targeted at increasing energy efficiency, reducing energy consumptions, decreasing the outgoing emissions and protecting the environment.By replacing the conventional lighting bulbs with cost-effective and economical special fixtures and lamps that use LED technology, these goals can be achieved. Thus, two tenders were procured (one for the Cultural Center and one for the Polytechnic Amphitheater). The contracts were awarded on the basis of the lowest compliant offer. The contractors were required to fully restore any damages caused during the supply phase to the facilities at no extra cost. They were also obliged to remove waste materials without any additional compensation and to deliver clean and ready to use building facilities. Furthermore, a five year at least guarantee was set.

5.8 GPP for indoor lighting for the Greek Central Government

The majority of the buildings used by the Greek Central Government are old and in order to cover their needs they consume high amounts of energy every year. The existent lighting bulbs used in most of them are energy-intensive, have short lifetime and demand a high maintenance, replacement and disposal cost. Thus, in the framework of GRASPINNO project, which was funded by the Interreg MED Programme, the General Secretariat of Commerce and Consumer Protection (GSCCP) of the Greek Ministry of Economy and Development prepared and published a green tender for indoor lighting. More specifically, GSCCP published a Framework Agreement for replacement of the existing internal lighting with new energy efficient ones in terms of the general

scope of green public procurement policy (all waste lamps shall be separated and sent for recycling). For the preparation of the green tender the GRASPINNO Unified Platform was used as a supportive tool. The GRASPINNO Unified Platform includes three different tools: GRASPINNO Database, e-GPP support tool and LCC Calculating tool. During the preparation of the green tender, procurers consult the GRASPINNO Database in order to identify the green products and services that are available in the market before defining the green criteria. Furthermore, the e-GPP tool supported them during the development of the tender documents including strict green characteristics.

5.9 Energy Efficient Street Lighting, Rotterdam, the Netherlands

The City of Rotterdam is the second largest city in the Netherlands and has a population of approximately 610,000 people.Each night, approximately 106,500 light sources illuminate the City of Rotterdam's roads, cycle paths, pavements and shopping areas. In the past, maintaining these light sources required the replacement of approximately 4,000 light fixtures at the end of their life cycle each year. Also, as there was little or no consistency as regards the types of light fixtures and lamps installed, carrying out maintenance and repair work was expensive and time consuming. Therefore, the City of Rotterdam published a tender in 2012 for the purchase of standard lighting fixtures for the whole city for the period 2013 to 2020. The form of the tender was an e-auction in three lots, with one framework agreement for each lot. The City wanted to ensure that sustainability was considered in all aspects of the production process, i.e. from the sourcing of raw materials to the end of the products life, and therefore requested that the light fixtures contain recycled materials and be recyclable at the end of their product life.

5.10 Smart Energy Metering

At the heart of the implementation of digitalization in Smart Cities lies the installation of smart meters at a broad range of buildings, from public and municipality buildings to domestic residencies. A critical factor for the success of this attempt is the easy installation of meters that are small enough to fit even to small electrical panels. Smart metering at high resolution is the first step towards performing multiple analyses that might lead to feasible corrective actions. The acquisition of accurate real-time data from installations in real-world conditions is the key to the deployment of a smart city framework.

Public and private organizations in the energy field across the globe have described the necessary characteristics of submeters with emphasis on the size, cost, and ease of installation. More

specifically, the U.S. Department of Energy (DOE) stated that the specifications and attributes of an acceptable wireless metering system should include:

1. Low-cost meters;
2. Electrical energy measurement units easy to use and quick to install;
3. Full compliance with NFPA 70 and UL 61010;
4. Wireless data communication success rate greater than or equal to 95%;
5. Operation independent from existing building internet and intranet networks;
6. All data encrypted using 128-bit or greater Advanced Encryption Standard.

Moreover, the Electric Power Research Institute (EPRI) has performed multiple research studies related to the efficiency of the installation of low-cost submeters to commercial and industrial sites. The objective is that in order to apply energy efficiency actions on buildings, real-time energy monitoring through low-cost submeters is necessary. Again, easy installation along with low cost are critical factors in order to work towards energy efficiency in bigger volumes.

Apart from the above, it is important to mention that there is a need for systematic energy audits in buildings to achieve energy efficiency. The guidelines that frame the energy audit procedure include the following:

- Audits should be based on up-to-date, measurable energy data as well as characteristics related to energy load;
- A detailed overview of energy consumption characteristics of a building should be available;
- Energy audits should be proportionate and sufficiently representative in order to give a reliable picture of overall energy efficiency and identify the most important opportunities for improvement;
- Data used for energy audits should be stored so as to enable future analysis of energy efficiency.

The necessity for reliable submeters that measure the overall consumption as well as individual loads within each facility is noticed with the quality of the submeters being crucial for accurately monitoring the energy loads of buildings. It is made clear from the aforementioned statements that the first step towards any kind of energy analysis is the installation of appropriate submeters to buildings of interest, able to measure the energy characteristics that can make a difference in energy efficiency plans.

5.11 "Les Aqueducts" ValEnergies building

ValEnergiesis a company with expertise in photovoltaics, energy efficiency and Smart Grid. Its mission is to prove with ambitious achievements that the pillars of energy transition are within the reach of companies (intelligent photovoltaic self-consumption, energy efficiency, storage of energy, electromobility and charging stations). It offers solutions for solar energy production, energy efficiency and consumption control. ValEnergies was founded in 2008 and is a leader of photovoltaics in France. It is part of the Valfidusgroup positioning itself sustainably in the building energy market.

"Les Aqueducts" smart building is in Valbonne Sophia Antipolis. It represents actually a "Mini Quartier" of 4 buildings that produce and share energy among them. The buildings produce energy via photovoltaics autonomously. There are energy meters for measuring the consumption, monitoring of the energy produced and consumed, exchange of energy between the buildings, energy storage batteries. There are also charging stations for electromobility. For energy efficiency there is external insulation and double flux ventilation. There are also some office automation solutions. Photovoltaics cover 50% of total yearly energy needs of the building.

5.12 Svalin Community, Denmark

Svalin is a community of 20 households in Trekroner, Roskilde, Denmark. The community, both houses and shared infrastructure, accommodate energy relevant infrastructure, such as PV panels, geothermic heat pump, and electric vehicles. The community as a whole is energy positive, producing more energy that it consumes. The community enrolls into the Energy Collectiveproject. The project discusses direct sharing and trading of electric energy among peers without the intervention of the national grid. This approach drives towards more customer-centric energy market. Svalin community provides a real-world experiment for the project. The project approach involves consumer centric electricity market relying on energy collectives and peer-to-peer setups, and proposes blockchain technology as the backbone support technology.

5.13 EnergyLabNordhavn, Denmark

The EnergyLabNordhavn[9] is a project developed between 2015-2019 at Copenhagen's Nordhavn offering a full-scale smart city energy lab. The purpose is to demonstrate how electricity and heating, smart energy-efficient buildings, electric transport can be integrated towards an intelligent, flexible and optimized energy system.

[9]http://www.energylabnordhavn.com/

The project is supported by Energy Technology Development and Demonstration Programme[10] and it relies on an ecosystem of collaborating partners: DTU, City of Copenhagen[11], CPH City and Port Development[12], HOFOR[13], Radius[14], ABB[15], Danfoss[16], Balslev[17], Nerve Smart Systems[18], Glen Dimplex[19], MetroTherm[20], and PowerLabDK.

Different pilots are demonstrated at the site of the Nordhavn towards achieving an integrated energy system:

- A large battery is integrated into the power grid supporting supply of electricity during peak loads and utilizing power from renewables such as wind turbines and PV panels;
- At Copenhagen International School the largest set of solar panels in Nordhavn makes it a large prosumer. Energy flexibility of the building is achieved via building management system;
- District heating in combination to a heat pump offers also hot water use. A storage tank is used to provide flexibility;
- Twelve apartments are equipped with advanced home automation systems and provide their data to demonstrate contribution of flexible households to energy system optimized operation;
- At harbor park thermal heat capacity is added as a flexible element of the energy system by short-term reductions of interruptions of district heating supply without influence to the customer comfort levels;
- Smart control of heating systems in 85 apartments provides extra flexibility
- Water heaters in a set of town houses provide flexibility shifting between district and electric heating;
- A large heat pump at the cruise terminal is used as a flexible element on the electricity market and for charging cruise ships;
- Energy.Hub is a co-working platform for companies in the field of urban development and energy solutions.

All these interventions drive towards Denmark's national goal of becoming totally independent from fossil fuels by 2050.

[10]https://ens.dk/ansvarsomraader/forskning-udvikling/eudp
[11]https://www.kk.dk/
[12]https://byoghavn.dk/
[13]https://www.hofor.dk/privat/
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5.14 Doll Living Lab, Denmark

Doll Living Lab[21] is a leading institution of its kind in Europe for intelligent lighting and Smart City services. Its purpose is to act as a bridge between the industry, academia/research and the public sector towards development of sustainable cities through technological innovation.

Its main focus is on offering demonstration and testing of the latest solutions related to Smart Cities in a number of sectors such as Digital Infrastructure (City WiFi, Mobile/GSM Networks, Low Power Wide Area Networks), Outdoor Lighting (Intelligent solutions, Light management systems, built-in Smart Technologies), Environmental Monitoring (Air Quality, Noise Pollution, Temperature), Waste Management (Sensor-based systems, End-to-End cases), Parking and Mobility (Sensor based parking systems, Electric Vehicle Charging Systems, Traffic counting systems, Autonomous Vehicles). The objective is to offer an integrated approach towards facing these challenges instead of traditional silo approach.

Doll is formed by a consortium of DTU, City of Albertslund[22], and GATE21[23], receiving funding from local, regional, national and European sources. A number of providers of Smart City IoT devices, providers of digital networks and IoT platform environments, and knowledge partners have joined forces to enable testing and demonstration cases.

Doll work is taking into account the following elements:

- Urban development comprising Sustainable Urban Planning, Local climate strategies, Action plans, and Liveabiliy
- Sustainability comprising UN Development goals, Energy effectiveness, and Resource optimization
- Ecosystem between industry and knowledge stakeholders consisting of Smart City Cluster Denmark, Open & Agile Smart Cities, The Academy for Smarter Communities
- Digitization and IoT including Smart City concept, IoT, Big Data, Digital Infrastructures, Digital Solutions
- Usecases on real scale being real life, plug and play, practice oriented, of system perspective, tested and demonstrated.

[21]https://doll-livinglab.com/
[22]https://albertslund.dk/servicemenu/english/
[23]https://www.gate21.dk/

6 Guideline on implementation of Session 3

Each partner has to present case studies coming from the local experience associated mainly to the two technological themes of Esmartcity project, i.e. Smart Public Building and Smart Street Lighting, eventually leading to new services for the citizen that could be easily added to the already offered ones.

For example, other services provided are:

- Abruzzo Region - Electrical parameters, panel-mounted remote-control devices at the lighting framework level:
  - 1 weather station, i.e. Wireless Plus station for the measurement of the meteorological parameters, solar and ultraviolet radiation, Including software module;
  - Traffic analysis (enabled for TAI adaptive lighting);
  - 2 video cameras and broadband conveyed wave system.

- APEGR - Measurement of PM2,5, PM10, Temperature and Relative Humidity.
- RAIS – Measurement of air quality by air quality sensor, based on $PM_{2.5}$ particles level, measurements of temperature, humidity and pressure.
- INSA LYON - The system monitors some environment variables (temperature, humidity, sound level) of interest per se. The objective is however to correlate them to the street usage.

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8 List of figures

9 Annex 1- Evaluation form

WORKSHOP TOPIC

DATE, MUNICIPALITY/REGION - COUNTRY

EVALUATION FORM

Thank you for attending this workshop organised within the frame of the ESMARTCITY project. We would greatly appreciate your feedback to help us improve future workshops.

1. Please note the type of your organisation:

   ☐ Regional authority

   ☐ Local authority

2. What is your occupation/position:

   ☐ Management

   ☐ City council member

   ☐ Administration

Please rate your answers using the following scale	**1 Very Poor**	**2**	**3**	**4**	**5 Excellent**
Organization	1	2	3	4	5
Welcome and registration	1	2	3	4	5
Catering	1	2	3	4	5
Venue	1	2	3	4	5
Training	1	2	3	4	5
Training Session 1: European Smarter Cities					
This topic was relevant and of interest	1	2	3	4	5
The presentations covered this topic	1	2	3	4	5
Trainers were knowledgeable of their topic	1	2	3	4	5

Training (continued)	1	2	3	4	5
Training Session 2: Innovative approach in Funding Policies					
This topic was relevant and of interest	1	2	3	4	5
The presentations covered this topic	1	2	3	4	5
Trainers were knowledgeable of their topic	1	2	3	4	5
The discussion session was fruitful	1	2	3	4	5
The best practice examples presented were inspiring and useful	1	2	3	4	5
Handouts – Training/Informational materials	1	2	3	4	5
Training Session 3: New technologies in the service of citizens					
This topic was relevant and of interest	1	2	3	4	5
The presentations covered this topic	1	2	3	4	5
Trainers were knowledgeable of their topic	1	2	3	4	5
The discussion session was fruitful	1	2	3	4	5
The best practice examples presented were inspiring and useful	1	2	3	4	5
Handouts – Training/Informational materials	1	2	3	4	5

Overall Evaluation					
What is your overall appreciation of the quality of the workshop?	1	2	3	4	5
Do you feel that the workshop met your expectations?	yes ☐		no ☐		
Have you got any significant input from the workshop?	yes ☐		no ☐		

In your view is there anything that we should improve in future workshops?

_____

_____

_____

Do you have any additional comment or/and recommendations:

_____

_____

_____

Thank you for your participation!

Project co-financed by the European Regional Development Fund